Computer Problem 4: Redoing Gini Ratio Study

The residuals of the model for Computer Problem 1 show heteroskedasticity.

$$Gini_i = a + b1\ (GDP/N)_i + b2\ (GDP/N)_i^2 + \varepsilon_i \quad (1)$$

However, Var(ε) is not constant. This variance gets smaller as GDP/N increases, across countries.

To fix the heteroskedasticity problem, must make an assumption.

Assumption 1: $Var(\varepsilon_i) = [1/(GDP/N)_i]\ \sigma^2$. (2)

To fix this problem, given this assumption, consider the following GLS-transformation:

Let $V = 1/[Var(\varepsilon_i)] = 1/[1/((GDP/N)_i)^{1/2}] = GDP/N_i^{1/2}$. (3)

Then the GLS-transformed model to analyze using OLS is:

$VY = VX\beta + V\varepsilon$, or:

$$(Gini_i)*(GDP/N_i^{1/2}) = a + b1\ (GDP/N_i^{1/2})*(GDP/N_i) + b2\ (GDP/N_i^{1/2})*(GDP/N_i^2) + (GDP/N_i^{1/2})*\varepsilon_i \quad (4)$$

Note that, given Assumption 1, this transformed model has a constant variance:

$$Var((GDP/N_i^{1/2})*\varepsilon_i) = (GDP/N_i)*Var(\varepsilon_i) = (GDP/N_i)*[1/(GDP/N)_i]\ \sigma^2 = \sigma^2. \quad (5)$$

Run this GLS transformed model in (2) above.
Provide a valid test of the null hypothesis that b2 = 0.
Check the residuals of the transformed OLS regression, to investigate whether the residuals of the transformed model have a constant variance.